Catalog Number 7726018

Submerged Area/Velocity Sensor

USER MANUAL

September 2005 Edition 2

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Section 1 Specifications

Specifications are subject to change without notice. Performance will vary depending on channel size, channel shape, and site conditions.

Velocity Measurement	
For velocity performance specifications, refer to individual Sigma Automatic Sampler and Flow Meter specifications.	
Method	Doppler Ultrasound Twin 1 MHz piezoelectric crystals
Typical Minimum Depth	2 cm (0.8 in.)
Recommended Range	–1.52 to 6.10 m/s (–5 to 20 ft/s)
Level Measurement	
Method	Pressure transducer with stainless steel diaphragm
Accuracy (static)[1]	±0.16% full scale ±1.5% of reading at constant temp (± 2.5 °C) ±0.20% full scale ±1.75% of reading from 0 to 30 °C (32 to 86 °F) ±0.25% full scale ±2.1% of reading from 0 to 70 °C (32 to 158 °F)
Velocity-Induced Depth Error	Compensated based on pipe geometry and flow velocity.
Level Range	Standard: 0–3 m (0–10 ft) Extended: 0–9 m (0–30 ft)
Allowable Level	Standard: 10.5 m (34.5 ft) Extended: 31.5 m (103.5 ft)
General Attributes	
Air Intake	Atmospheric pressure reference is desiccant protected.
Operating Temperature Range	0 to 70 °C (32 to 158 °F)
Level Compensated Temperature Range	0 to 70 °C (32 to 158 °F)
Material	Noryl® outer shell with epoxy potting within
Power Consumption	≤1.2 W @ 12 VDC
Cable	Urethane sensor cable with air vent
Connector	Hard anodized; satisfies Military Spec 5015
Cable Lengths Available	Standard: 9, 15, 23, and 30.5 m (30, 50, 75, and 100 ft) Custom: 30.75 m (101 ft) to 76 m (250 ft) maximum
Cable Diameter	0.91 cm (0.36 in.)
Dimensions	2.3 cm H x 3.8 cm W x 13.5 cm L (0.9 in. H x 1.5 in. W x 5.31 in. L)
Compatible Instruments	910, 920, 930, 930 T, 950, 980, 900 Max, 900 Max Refrigerated Samplers, and 900 AWRS

[1] For temperatures above 40 °C (104 °F) add ± 0.3 cm/°C (0.03 in./°F)

Section 2 General Information

2.1 Theory of Operation

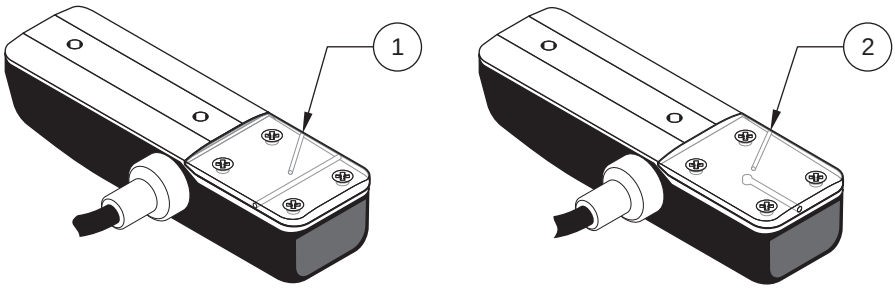
The Submerged Area/Velocity Sensor contains a pressure transducer for level measurement and a pair of ultrasonic transducers for velocity measurement. These two measurements are used to calculate flow in open channels.

The flow meter measures the pressure of the water and converts it into a level reading. The “wetted area” of the flow stream is then calculated using this level reading and the user-entered channel geometry. The flow meter then measures the Doppler shift in returned ultrasound and converts it into a velocity reading. The “wetted area” multiplied by the velocity equals the flow rate.

2.2 Sensor Overview

The sensor is available in two versions (Figure 1). The Non-oil sensor is used for reasonably clear sites or in sites where the pipe can become dry.
The Oil-filled sensor is used for sites with high levels of biological growth, grit, or silt. Do not use the Oil-filled sensor in a pipe that may become dry.

Figure 1 Non-oil and Oil-filled Sensors



1. Non-oil Sensor	**2.** Oil-filled Sensor

Section 3 Installing the Sensor

3.1 Zeroing the Sensor

The sensor has been factory-calibrated and compensated for temperature. The sensor needs to be zeroed during each installation, but does not require calibration. The sensor should be zeroed when moving it from one flow meter or sample to another.

To zero the sensor:

1. Install InSight version 5.7 or greater and start the program.
2. From the InSight software menu, select Remote Programming.
3. From the Real Time Operations list, select the level sensor to be calibrated.
4. Remove the probe from the liquid and place the sensor flat on the tabletop or floor with the sensor (the plate with the holes) facing down onto the surface.
5. Press **OK** on the dialog box when complete.

3.2 Important Guidelines for Sensor Installation

- Do not install more than one sensor at a time in pipes less than 61 cm (24 inches). Multiple sensors in smaller pipes can create turbulent or accelerated flows near the sensors that may cause inaccurate measurements.
- Mount the sensor as close as possible to the bottom of the pipe invert to most accurately measure low velocity levels.
- Do not monitor flows in the invert of the manhole itself. The best sensor location is 3 to 5 times the sewer diameter/height upstream of the invert.
- Locate monitoring sites as far from inflow junctions as possible to avoid interference caused by combined flows.
- Avoid sites that contain flow obstacles within 2 to 4 pipe diameters in front of the sensor installation (rocks, stones, pipe joints, valve stems, etc.) as these will contribute to turbulence and generate high speed flows in the immediate vicinity of the obstruction.

- Avoid any sites with slow moving flows that will encourage the buildup of silt in the invert or channel. Excessive silting around the sensor may inhibit the Doppler signal and decrease sensor accuracy, and may affect depth measurement accuracy.

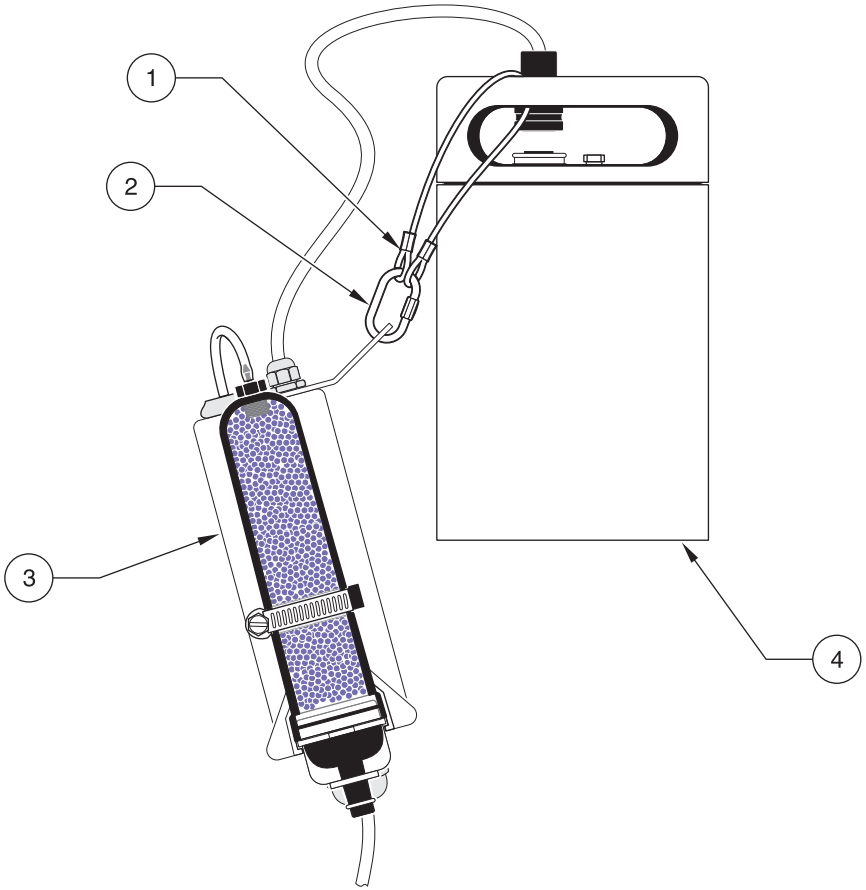
- Avoid sites with deep, rapid flows that will make it physically difficult or dangerous to install the sensor.

- Avoid sites with high velocity, low-depth flows. Splash-over and excessive turbulence will be present around the sensor and data may be inaccurate.

3.2.1 Proper Strain Relief of Sensor Cable

Attach the desiccant hub to the instrument handle to provide a strain relief for the sensor cable and connector (Figure 2).

Figure 2 Proper Strain Relief



1.	Lanyard	**3.**	Desiccant Hub
2.	Carabineer	**4.**	Flow Meter

3.3 Connecting the Sensor to the Mounting Bands

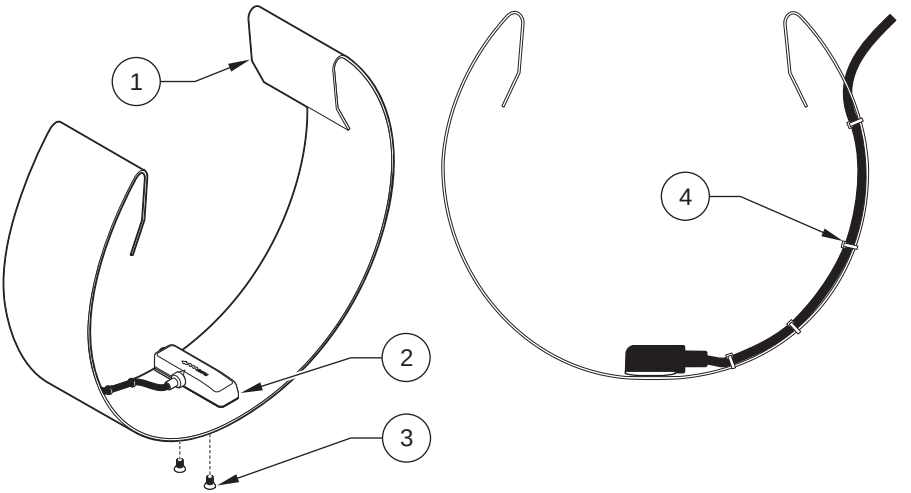
Important Note: *If using an oil-filled sensor, replenish the oil prior to mounting the sensor to a mounting band. Refer to section 4.1.2 on page 19 for oil replenishment instructions, if applicable.*

1. Attach the sensor to the spring ring. Mounting bands come with pre-drilled holes for direct mounting of the sensor to the band.

2. To reduce the likelihood of debris collecting on the cable and mounting band, route the cable along the edge of the band and fasten the cable to the mounting band with nylon wire ties (Figure 3). The cable should exit the tied area at, or near, the top of the pipe to keep it out of the flow stream.

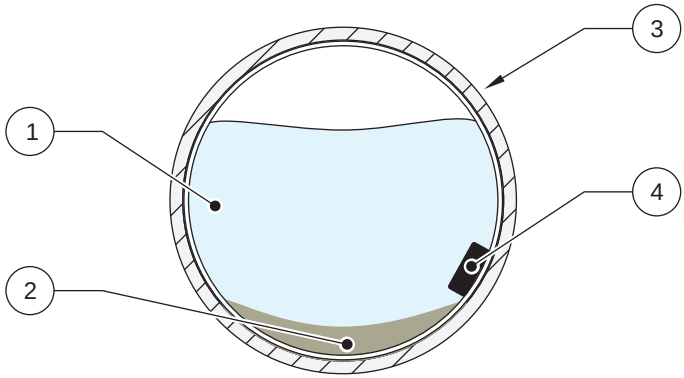
Note: *If there is a large amount of silt in the bottom of the pipe, rotate the band until the sensor is out of the silt (Figure 4), assuring that the sensor remains below the minimum expected water level at all times. Silt should not be disturbed and must be measured frequently.*

Figure 3 Attaching the Sensor to the Mounting Band



1.	Spring Ring	**3.**	Screws (2)
2.	Sensor	**4.**	Nylon Wire Ties

Figure 4 Avoiding Silt when Mounting the Sensor



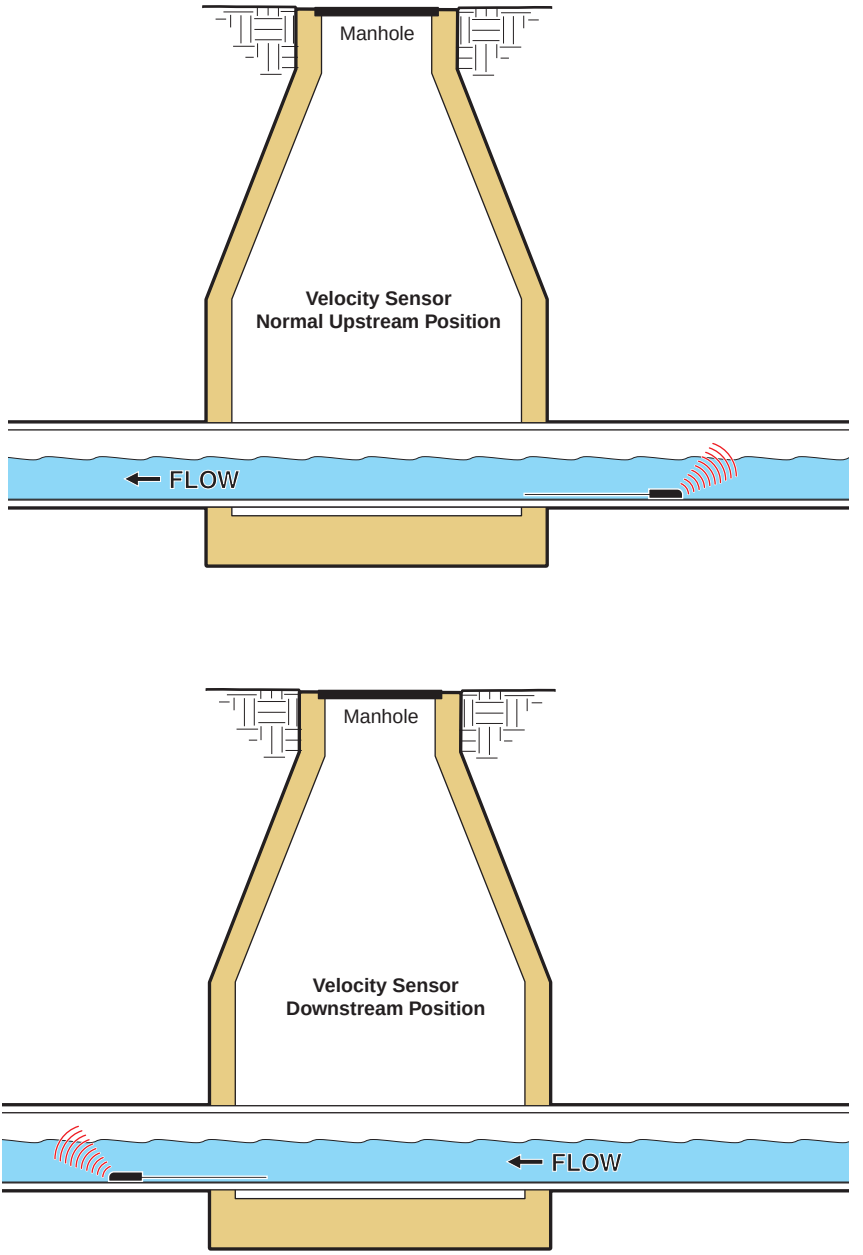
1. Water	**2.** Silt	**3.** Pipe	**4.** Sensor

3.4 Placing the Sensor and Mounting Band into the Pipe

Point the angle-face of the sensor into the flow. The manufacturer recommends placing the sensor with the arrow pointing with the flow (Figure 5). For other mounting configurations, see the appropriate flow meter manual.

Slide the mounting band as far into the pipe as possible to eliminate drawdown effects near the end of the pipe. Locate the sensor at the bottom-most point in the channel. If excessive silt is present on the bottom of the pipe, rotate the band in the pipe until the sensor is out of the silt.

Figure 5 Placing the Sensor into the Flow



3.5 Compensating for Velocity Direction

When programming the sensor the following may be selected:

Option[1]	Description
Upstream (recommended for most applications)	Use this option at sites with fairly consistent velocities, and low to medium turbulence. The flow stream over the sensor should be relatively straight, with no drops or turns near the measurement point.
	Mount the sensor in the pipe, beveled edge facing into the flow, where the flow stream enters the measurement area (Figure 5).
Downstream	Use this option when the sensor is installed downstream of the measurement point (where the flow stream exits the site). This option is useful when more than one flow stream enters a site and the combined flow of all streams at a single exit point is measured.
	Mount the sensor in the downstream direction rather than the typical, upstream direction. Mounting the sensor 'backwards' in this manner (Figure 5) causes the velocity direction readings to be the opposite of actual stream flow. By selecting the Downstream choice when programming, the logger reverses the measured signal to show actual flow direction (beveled edge downstream). The maximum velocity obtained in this type of installation is 5 fps.

[1] Additional options may be available depending on the flow meter or sampler used. Refer to the appropriate flow meter or sampler manual for more information.

3.6 Performing a Level Adjustment

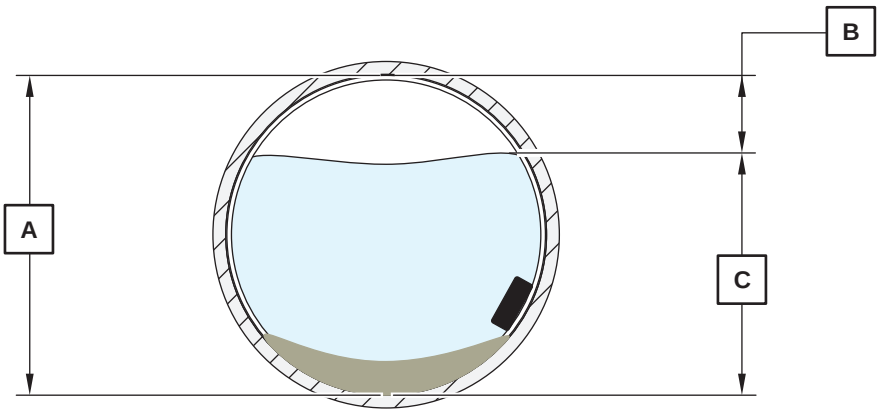
The manufacturer recommends doing a level adjustment whenever a sensor is first installed into a flow stream. This adjustment accounts for the various physical tolerance stack-ups in the system (i.e., thickness of the mounting band, angular placement of the sensor relative to the “6 O’ clock” position in the pipe, etc.)

1. With the sensor installed in the flow, use a PC or display (950 and 980 flowmeter) to monitor Current Status.

2. Take a physical measurement of the water depth by measuring the distance from the top of the pipe to the surface of the water (item B, Figure 6), and subtracting this number from the pipe diameter (item A, Figure 6). The resulting number is the water depth (item C, Figure 6).

3. Enter the physically-measured water depth into the software using the Adjust Level function.

Figure 6 Measuring the Water Level



Section 4 Sensor Maintenance

4.1 Sensor Maintenance

4.1.1 Cleaning the Sensor (Oil-filled and Standard)

Clean the transducer port when:

- Unexpected increase or decrease in flow or level trend occurs
- Level data are missing or incorrect but velocity data are valid.
- Excessive silt has deposited between the transducer and its protective cover.

4.1.1.1 Cleaning the Sensor (Oil-filled and Non-oil)

Important Note: *Do NOT interchange an oil-filled protective cover plate with a non-oil cover plate. This will adversely affect level readings. It is possible to convert one type of sensor to the other using the Oil Probe Conversion Kit (Cat. No. 7730000), refer to the Oil Probe Conversion Kit Instruction Sheet, Cat. No. 7730089 for more information.*

Important Note: *When cleaning the transducer, use the most gentle technique possible. Do not use sharp or pointed objects to remove sediment from the face of the transducer. If you nick or dent the transducer, it will break!*

1. Soak the sensor in soapy water

Note: *Do not soak the sensor in bleach. Bleach will permanently damage the sensor. Refer to Table 1 for acceptable cleaning solutions.*

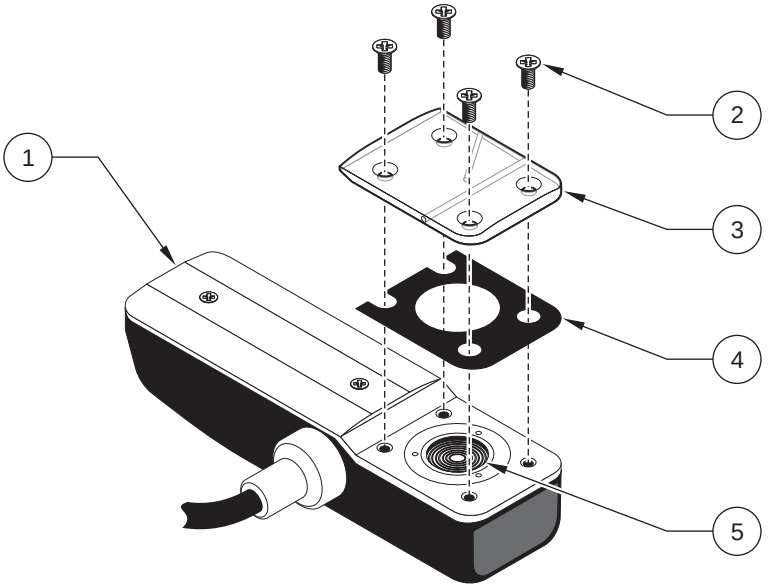
Table 1 Cleaning Solutions

Acceptable	Unacceptable
Dish Detergent and Water	Concentrated Bleach
Window Cleaner	Kerosene
Isopropyl Alcohol	Gasoline
Dilute Acids	Aromatic Hydrocarbons

2. Remove the screws from the protective cover (Figure 7).
3. Remove the cover and gasket.
4. Carefully swirl the sensor in an appropriate cleaning solution to remove soil. Use a spray or squeeze bottle to wash away heavier deposits.
5. Clean the gasket and cover. Replace the gasket (Cat. No. 7722000) if it is torn or damaged. Level readings will be adversely affected if the gasket is damaged or not installed.
6. Reattach the gasket and cover (note orientation in Figure 7). Tighten the screws until the gasket starts to compress.

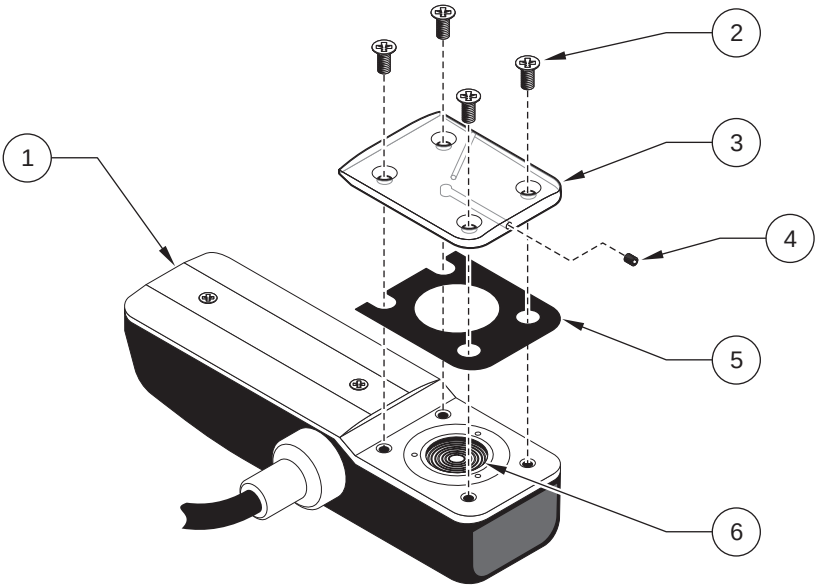
7. If using an oil-filled sensor, continue to Oil Replenishment (Oil Kit Cat. No. 7724800) on page 19.

Figure 7 Removing the Protective Cover (Non-Oil Sensor)



1.	Sensor	**4.**	Gasket
2.	Screws (#6–32 x 5/16)	**5.**	Pressure Transducer
3.	Protective Cover		

Figure 8 Removing the Protective Cover (Oil-filled Sensor)



1.	Sensor	**4.**	Screw, set, #2-56
2.	Screws (#6–32 x 5/16)	**5.**	Gasket
3.	Protective Cover	**6.**	Pressure Transducer

4.1.2 Oil Replenishment (Oil Kit Cat. No. 7724800)

The manufacturer recommends inspecting the oil in the sensor for large air bubbles during the customer-scheduled service duty cycle, and prior to every installation. Small bubbles (less than ¼-in. diameter) of air within the oil do not affect performance. Larger bubbles may minimize the anti-fouling benefit of the oil.

To replenish sensor oil:

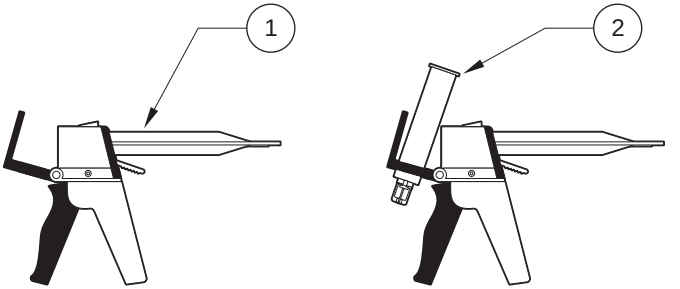
1. If the sensor is new, remove the yellow tape on the sensor.
2. Remove any debris from the sensor.
3. Load the oil cartridge into the dispensing gun (Figure 9).
4. Twist the feed tube onto the cartridge and attach the syringe tip to the feed tube (Figure 10).
5. Press the dispenser gun handle to purge any air bubbles from the syringe tip.

6. Remove the set screw in the transducer cover with the supplied 0.035 hex wrench. Retain the set screw.
7. Slowly insert the syringe tip into the set screw hole and dispense the oil (Figure 11). While dispensing the oil, hold the probe at an angle to allow the air to be pushed out the side port (Figure 11). Continue to dispense the oil until all the air bubbles are removed.

Note: *Slowly insert the syringe tip and do not dispense oil during insertion or damage to the transducer may occur if too much pressure is applied.*

8. Continue to dispense the oil while removing the syringe from the set screw hole to prevent air bubbles. Replace the set screw until it is flush with the transducer cover and remove any excess oil around the screw hole or on the sensor.
9. Clean the entire probe and place a piece of electrical tape over the side port to prevent oil from leaking out. Remove the tape from the sensor prior to zeroing and installing the sensor.

Figure 9 Loading the Cartridge into the Dispensing Gun



1. Dispensing Gun	**2.** Silicone Oil Cartridge

Figure 10 Attaching the Feed Tube and Syringe

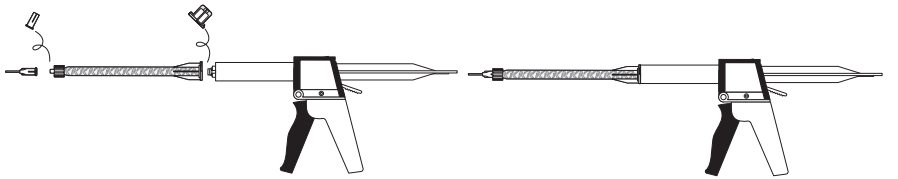
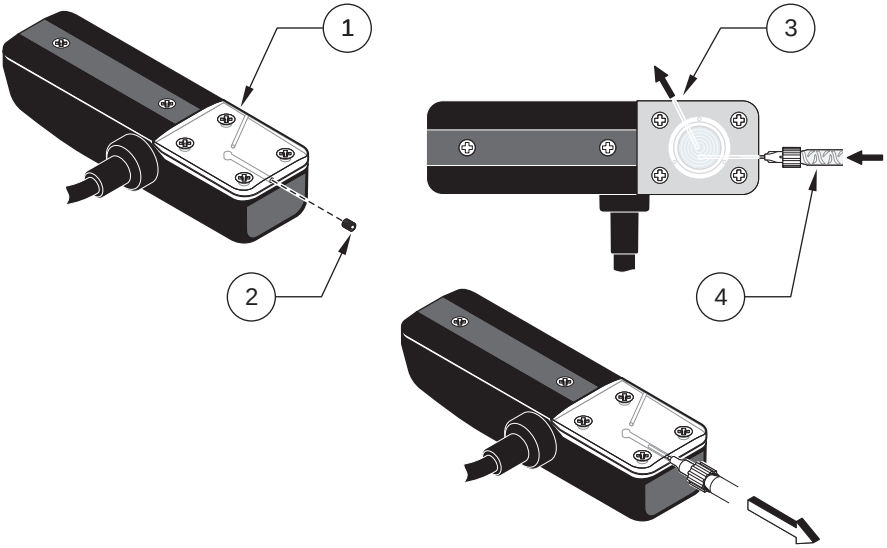


Figure 11 Oil Replenishment



1.	Sensor	**3.**	Side port
2.	Set screw	**4.**	Syringe

4.2 Changing the Sensor Desiccant

The desiccant canister contains beads of silica gel which ensure proper orientation of the pressure transducer. When the beads are blue, they can remove moisture from the air. When they are pink, they are saturated and cannot absorb any more moisture from the air, and they must be replaced immediately.

Important Note: *When the beads begin to turn pink, replace or rejuvenate the beads. Permanent damage to the sensor may occur if the desiccant is not maintained. Never operate the sensor without the proper desiccant. When rejuvenating beads, remove them from the canister and heat at 100–180 °C (212–350 °F) until the beads turn blue. If the beads do not turn blue, replace them with new beads. Do not heat the canister.*

4.2.1 Desiccant Replacement Procedure

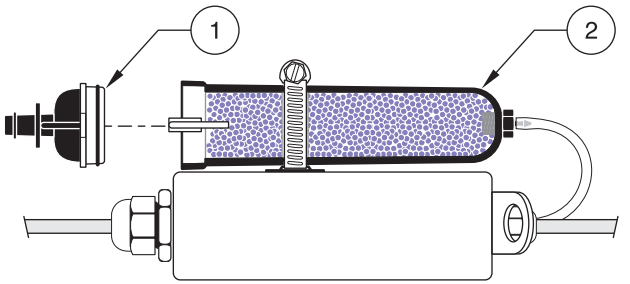
Note: *Replacing the desiccant does not require that the desiccant container be removed from the desiccant box.*

1. Use a slight twisting motion to twist the bottom end-cap until its slots align with the retaining clips (Figure 12).
2. Gently remove the end cap by grasping it and pulling it straight out.
3. Pour the desiccant beads out of the canister.
4. Hold the canister up to the light and inspect the hydrophobic filter.
   - If you see a small, dim light spot while looking through the hole, the filter is in good condition. If you see a bright light spot, the filter is probably torn. Replace the filter.
   - If the desiccant beads were completely saturated with water or the filter has saturated with water or grease, replace the filter.
5. Refill the canister tube with blue desiccant beads (Cat. No. 3624). Inspect the O-ring (Cat. No. 5252) on the bottom cap for cracking, pits, or evidence of leakage. Replace if necessary.

Note: *Applying O-ring grease to new or dry O-rings improves the ease of insertion, sealing, and life span of the O-ring.*

6. Make sure that the O-ring is clean and free of dirt or debris before replacing the end cap.
7. Reinstall the end cap.

Figure 12 Removing the Bottom End Cap



1. End Cap	**2.** Desiccant Container

4.3 Hydrophobic Filter Description

A single Teflon® hydrophobic filter (Cat. No. 3390) is installed in the top of the canister to prevent liquid from entering the vent tube.

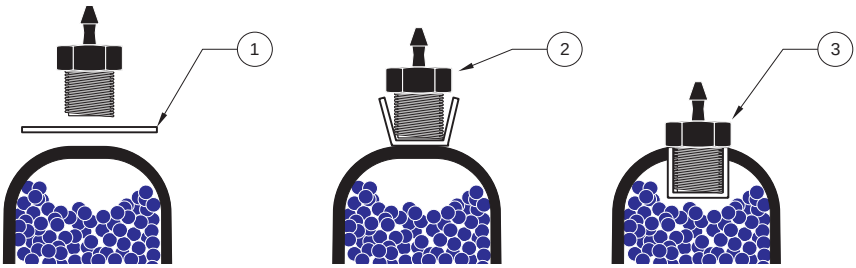
For best performance and to avoid grease buildup on the filter during submergence or surcharge conditions, hang the canister vertically so that the end facing the sensor points downward.

Note: *The Hydrophobic Filter may need replacement at any time the cartridge is submerged or exposed to excess moisture. Refer to section 4.4.*

4.4 Hydrophobic Filter Replacement Procedure

1. Disconnect the tubing from the top of the desiccant canister.
2. Unscrew the hex-head tubing nipple from the top of the canister and discard the old filter.
3. Discard any remnants of Teflon tape from the nipple's threads. Reapply two turns of Teflon tape (Cat. No. 10851-45) to the threads, pulling the tape into the threads until it conforms to the shape of the threads.
4. Place a new filter over the hole. Make sure that the smooth side of the filter faces the inside of the canister (Figure 13).
5. Place the threaded nipple on top of the filter.
6. With a slight pressure, press the filter into the hole with the nipple threads and begin threading the nipple into the hole. The filter will deflect upward and feed completely into the thread until it disappears. The filter must rotate with the nipple as it is threaded into the cap. If it does not, it is torn. Start over with a new filter.
7. Inspect the installation. In the upper cap, a small, dim light spot should be visible when held up to the light. A bright spot indicates a torn filter. Start over with a new filter.

Figure 13 Replacing the Hydrophobic Filter



1. Filter, smooth side down	**2.** Hex-head tubing nipple	**3.** Finished assembly.

Section 5 Parts and Accessories

5.1 Group 77000 Series

Description	Depth	Cat. No.
Oil-Filled Submerged AV Sensor, 0–10 ft range, 30 ft cable, with connector	0–10 ft	77064-030
Oil-Filled Submerged AV Sensor, 0–10 ft range, 50 ft cable, with connector	0–10 ft	77064-050
Oil-Filled Submerged AV Sensor, 0–10 ft range, 75 ft cable, with connector	0–10 ft	77064-075
Oil-Filled Submerged AV Sensor, 0–10 ft range, 100 ft cable, with connector	0–10 ft	77064-100
Oil-Filled Submerged AV Sensor, 0–10 ft range, custom cable, with connector	0–10 ft	77064-XXX
Oil-Filled Submerged AV Sensor, 0–30 ft range, 30 ft cable, with connector	0–30 ft	77074-030
Oil-Filled Submerged AV Sensor, 0–30 ft range, 50 ft cable, with connector	0–30 ft	77074-050
Oil-Filled Submerged AV Sensor, 0–30 ft range, 75 ft cable, with connector	0–30 ft	77074-075
Oil-Filled Submerged AV Sensor, 0–30 ft range, 100 ft cable, with connector	0–30 ft	77074-100
Oil-Filled Submerged AV Sensor, 0–30 ft range, custom cable, with connector	0–30 ft	77074-XXX

5.2 Oil-Filled Area Velocity Sensors with Bare Leads

Description	Depth	Cat. No.
Oil-Filled Submerged AV Sensor, 0–10 ft range, 30 ft cable, with bare leads for barrier box	0–10 ft	77264-030
Oil-Filled Submerged AV Sensor, 0–10 ft range, custom cable, with bare leads for barrier box	0–10 ft	77264-XXX
Oil-Filled Submerged AV Sensor, 0–30 ft range, 30 ft cable, with bare leads for barrier box	0–30 ft	77274-030
Oil-Filled Submerged AV Sensor, 0–30 ft range, custom cable, with bare leads for barrier box	0–30 ft	77274-XXX

5.3 Standard Area Velocity Sensors with Connectors

Description	Depth	Cat. No.
Submerged AV Sensor, 0–10 ft range, 30 ft cable, with connector	0–10 ft	77065-030
Submerged AV Sensor, 0–10 ft range, 50 ft cable, with connector	0–10 ft	77065-050
Submerged AV Sensor, 0–10 ft range, 75 ft cable, with connector	0–10 ft	77065-075
Submerged AV Sensor, 0–10 ft range, 100 ft cable, with connector	0–10 ft	77065-100
Submerged AV Sensor, 0–30 ft range, custom cable, with connector	0–10 ft	77065-XXX
Submerged AV Sensor, 0–30 ft range, 30 ft cable, with connector	0–30 ft	77075-030
Submerged AV Sensor, 0–30 ft range, 50 ft cable, with connector	0–30 ft	77075-050
Submerged AV Sensor, 0–30 ft range, 75 ft cable, with connector	0–30 ft	77075-075
Submerged AV Sensor, 0–30 ft range, 100 ft cable, with connector	0–30 ft	77075-100
Submerged AV Sensor, 0–30 ft range, custom cable, with connector	0–30 ft	77075-XXX

5.4 Standard Area Velocity Sensors with Bare Leads

Description	Depth	Cat. No.
Submerged AV Sensor, 0–10 ft range, 30 ft cable, with bare leads for barrier box	0–10 ft	77265-030
Submerged AV Sensor, 0–10 ft range, custom cable, with bare leads for barrier box	0–10 ft	77265-XXX
Submerged AV Sensor, 0–30 ft range, 30 ft cable, with bare leads for barrier box	0–30 ft	77275-030
Submerged AV Sensor, 0–30 ft range, custom cable, with bare leads for barrier box	0–30 ft	77275-XXX

5.5 Area Velocity Sensor Accessories

Description	Cat. No.
Custom cable connecting sensor to junction box. Cable lengths range from 1–99 ft	77155-PRB
Custom cable connecting junction box to hub. Cable lengths range from 1–99 ft	77155-HUB
Hub Assembly for Bare Wire	77228-00
Silicon oil dual 50-mL oil pack only. Refills 100 sensors	7724700
Silicon oil refill kit includes dispensing tool, dual 50-mL oil pack, instruction sheet and miscellaneous hardware. Refills 100 sensors	7724800
Instruction Sheet, Oil Fill Kit	7724789
Instruction Sheet, Bare Wire AV Probe	7725089
Instruction Sheet, Firmware Upgrade	7726089
Silicon Potting Gel Kit	7725600
Gel Fill (order three to fill a single junction box)	7729800
Gel Fill Dispensing Gun (also doubles as silicone oil fill gun)	7715300
Retrofit kit for transforming a sensor with a non-oil cover plate into Oil filled cover plate. Includes kit 77248-00	7730000

Section 6 Contact Information for U.S.A. and Outside Europe

Ordering Information for the U.S.A.

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH
(800)-227-4224

By Mail:

Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A

By Fax:

(970) 461-3914

Ordering information by E-mail:

orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

Ordering Information for Outside the U.S.A. and Europe

Hach Company maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send e-mail to techhelp@hach.com or visit www.hach.com.

Technical Support

Technical and Customer Service Department personnel are eager to answer questions about our products and their use. In the U.S.A., call 1-800-227-4224 or email techhelp@hach.com. Outside the U.S.A. and Europe, send e-mail to techhelp@hach.com.

Repair Service

Authorization must be obtained from Hach before sending any items for repair. Please contact the Hach Service Center serving your location.

Hach Company
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: 1-800-635-4567 or (970) 669-3050
Fax: (970) 669-2932

Section 7 Contact Information for Europe

For technical support, repair service, and ordering information please refer to the contact information below for your specific country. For additional information, visit www.hach-lange.com.

Austria
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A - 3200 Obergrafendorf
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Fax +43 (0)27 47 42 18
info@hach-lange.at

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info@hach-lange.be

Denmark
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DK-2650 Hvidovre
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Fax +45 (0)36 77 49 11
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France
Hach Lange
Hach SAS
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Fax +33 (0)1 48 15 80 00
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& CO. KG
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Fax +44 (0)12 56 33 07 24
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Fax +33 02 39 23 14-39
info@hach-lange.it

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PL-52-013 Wroclaw
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info@hach-lange.pl

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Fax +34 9 43 13 02 41
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Sweden
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Fax +46 (0)8 7 98 05 03
info@hach-lange.se

Switzerland
Dr. Bruno Lange AG
Juchstrasse 1
CH-8604 Hegnau
Tel. +41(0)1 9 45 66 10
Fax +41(0)1 9 45 66 76
info@hach-lange.ch

Section 8 Limited Warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing. Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.